

SUMMARY: PHOTOVOLTAIC INTERNATIONAL PLAN
MEETING

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, July 9, 1979

MIT Energy Laboratory Working Paper No.
MIT-EL-79-038WP

July 1979

Summary of Photovoltaic International Plan Meeting, July 9, 1979 at
Massachusetts Institute of Technology

The MIT workshop on the International plan for Photovoltaics was convened at the request of SERI and the Jet Propulsion Laboratories to bring together a group of individuals in the Cambridge area who had specific expertise in energy planning and finance in the developing nations. Appendix one contains a listing of those individuals present at the workshop. The agenda and preliminary list of questions prepared for the workshop is included as appendix two. While the materials discussed covered in large part the listing included in appendix two, they were not discussed in order. The report which follows will not attempt to present a chronology of the discussion, but will rather present a summary of the major points which came out of the workshop and present a set of alternative approaches for development of a photovoltaic market effort in the developing nations.

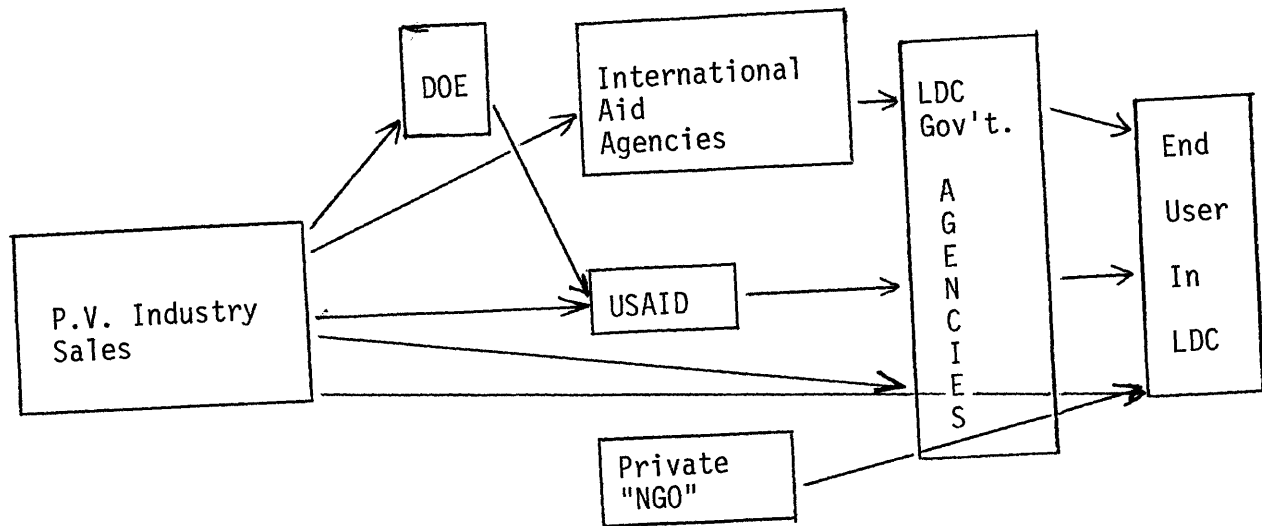
Figure 1 presents a schematic diagram of the alternative pathways open to the photovoltaics industry in sales to end users in the developing nations. Only one of these alternatives represents direct sales while all of the other alternatives represent sales either to or through governmental agencies in this country or in the host country. The discussion surrounding this schematic focused on the fact that it was extremely unlikely that there would be direct sales of photovoltaic products to end users in the developing nations for two reasons. The first and most significant reason was that even though there was a market for water or possibly for pumping there was not a market for energy divorced from its end use. As a result it was felt that there would not be a market for photovoltaics even though there might well be a market for a system such as an irrigation or village electrification which could be photovoltaic powered. The second reason for there not to be sales directly to end users was that the end users in the developing nations required extensive financing to be able to purchase any type of capital good. This financing most frequently comes through governmental intervention and then frequently through multilateral or bilateral financing agreements between the host nations and the donor nations.

The participants emphasized that there is a separation between "need" and "demand" which must be made whenever one discusses the market potential in the developing nations. Smith and others have analyzed the potential need for photovoltaic microirrigation systems yet there has not been demonstrated to be a demand. The need is present and it would appear that a demand might also exist at a favorable system price. The demand has not been demonstrated and, indeed it will not be demonstrated until there is a sufficient number of systems fielded and financing available for the purchase of such systems. While farmers may see the need and understand it, their ability to translate that need into a demand required considerable additional assistance.

The above considerations led to a set of proposed methods of intervention which the DOE could follow to have an impact upon the potential market for photovoltaics in the developing nations. These are:

- o Intervention into existing projects
- o Informed manpower availability

FIGURE 1



- o Circular letters of project possibility inside of USAID
- o Cooperative effort with oil nation development program
- o Energy Technical training program
- o Grass roots agency development and implementation program

At the conclusion of the discussions an executive session developed another alternative:

- o Staged industry systems development and deployment

Intervention into existing projects.

The argument was made that it is not possible to design a project using a technology which is totally unproven but that it is possible to enter into a project which has been initiated and provide -- with guarantees of performance -- a portion of the system requirements. The example given was in terms of the small scale irrigation projects which are underway in a number of countries. Were there to be an active intervention program developed it would be possible to add photovoltaic power systems into projects on irrigation both to test their viability and to begin to make the engineering and systems people who are responsible for the design of such projects aware of the potential of photovoltaics while converging all down side risk. In so doing, photovoltaic systems are seen and handled and are tested in an environment where they are compared directly with the competition. The sense of the meeting was that the type of intervention would offer the greatest possibility for a rapid entry into the sphere of international aid giving agencies as it would bring photovoltaic power systems into their legitimate decision and operating structure. To accomplish this effort would require that all differential costs be born outside of the irrigation (or other) project and that there be a guarantee of performance which if not met would require the replacement of the photovoltaic system by the dominant alternative.

Informed manpower availability.

A major consideration in choosing or not choosing a given alternative in development projects is information available to the development teams or missions which prepare the scope of a project. Given this requirement for information it was proposed that there be made available a cadre of trained and knowledgeable individuals who could -- at no cost to the aid agency -- be provided to missions concerned with either irrigation or with village electrification and who could introduce -- where applicable -- photovoltaic power systems as alternatives in given projects. This proposal was considered as significant for two reasons. The first was that it would be possible to enter photovoltaics into the vocabulary of the projects themselves and the second was that it would be possible to act as educators of the more traditional loan officers and engineers/economists who people the aid missions today.

Circular letters of project possibilities inside of USAID.

Within USAID there is a channel by which circular letters may be distributed

to all of the missions soliciting interest in a particular type of development activity. In the case of the photovoltaic technology such a letter would need to present the technology in brief, present a listing of likely applications of the technology with a brief description of each and then offer additional sources of information including a Washington drop point at which information and manpower could be directed toward a particular missions needs. Such a missile circulated within the USAID would have the advantage of reaching all of the missions and reaching a fairly broad spectrum of mission personnel. If acted upon it would offer programatic support in the field and would offer a mechanism by which a major program could be initiated. The approach has the disadvantage of requiring that there be an initial response from what may be an overtaxed staff within the mission.

Cooperative effort with an Oil Nation Development Program.

A number of oil rich nations individually and collectively have begun to assist the non-oil rich nations in their efforts to survive increased oil prices. In particular the Saudis have been concerned with increasing world food output. As such these sources offer possibilities for developing food and energy related projects in the developing nations, particularly the Moslem nations which form a major block of South and Southeast Asia and Africa. This proposal has the advantage of external funding of the project but the disadvantage of requiring a means of entering the project schedule of the Saudis or other potential donor.

Energy Technical Training Program.

Many of the developing nations are sending representatives to programs such as the Brookhaven Energy Management Program at which the new technologies are being presented. Additional effort could be placed on presenting photovoltaics as a viable option for specific applications in the nations. Demonstrations of hardware and discussion of successful applications in other nations could greatly enhance the value of the presentation and training.

Grass roots agency development and implementation program.

There exist in the United States and in many of the developed nations voluntary agencies in operation at the village level in the developing nations. While these agencies receive a portion -- sometimes nearly all -- of their funding from governmental sources they perform their most significant function at the village level. Such agencies as Oxfam, CARE, and Catholic Relief Services to name only three have extensive staff operations and are frequently in a position to experiment with new techniques or technologies. It was unclear in the workshop what specific information would be required by the program officers of such an agency but it was suggested that they be approached for both interest and for a definition of their needs in order to experiment with or introduce such systems for irrigation or for village electrification through their agency wings in country.

Staged industry systems development and deployment.

There was considerable discussion throughout the workshop of the immaturity of the photovoltaics industry as it presently exists in entering a developing nation market. Workshop participants were not enthusiastic about suggestions of a program to subsidize joint venture marketing activities in an effort to team a U.S. photovoltaic manufacturer with an incountry distributor because they felt that such a team would still not be able to break into the market at the governmental level where one could generate a demand rather than merely discuss a need. To offer an alternative it was suggested that there be a staged program to involve present photovoltaics manufactures in systems development for developing nations applications followed by assisted depolymnt of test systems in specific locations. The three states of the proposal would be the following:

STAGE ONE: Issue an RFP for the development of nation or region specific applications for photovoltaic power systems which take into consideration first needs for which photovoltaics will have a market edge and second demands, i.e. areas in which funding for such an application would be forthcoming from within internal national funding or from international agencies. Such an effort would not be long in duration but would require a contractor who was knowledgeable in energy requirements in the developing nations not one who was knowledgeable in photovoltaics.

STAGE TWO: Issue RFPs or PRDAs for the development of systems which could be applied to the application requirements listed above. Here the need would be to develop systems aimed at specific geographic areas of specific generic markets in order for the contractors to develop system experience in meeting the engineering requirements of a specific application. The emphasis here must be upon engineering efficiencies and cost thus calling for cleverness in design with an eye to marketing of the project -- and possible assembly -- within a specific geographic region.

STAGE THREE: Given a set of succssssful systems designs, the next stage should be the incountry installation of a set of systems in conjunction with an incountry participant either a distributor or a manufacturer. The effort here is threefold. First testing of the equipment, second development of experience on the part of the U.S. supplier in dealing with the intricacies of developing nations and third, the development of an indigenous supply/marketing/manufacturing capability which is critical to the eventual market-ability of any device in the developing nations.

There are two points which came out in the discussion which do not fit well into the summary above but rather cut across all of the discussion. The first deals with the cost decline curve for photovoltaic hardware. The second deals with the nature of the good itself.

It was suggested that the photovoltaic hardware will be declining in cost over the next decade. Many of the participants saw this as a major selling point for the technology in discussions with the developing nations. The position of the U.S. may be one of offering a subsidy for the power system in response to a future decline in price. Under these circumstances it is possible for the nations or agencies to put photovoltaic power systems on equal footing with their alternatives and place photovoltaic systems into applications which will be cost effective in the near future rather than the present.

The second point was raised by several participants with extensive experience in both the politics of the developing nations and the rural energy environment. It was pointed out that providing power or water was long seen as a political/economics means of controlling populations. Having electricity in Indonesian villages was something that was handed out by the central government. A diesel engine generator set represented a large block of capital to the villagers but they had to struggle mightily to pay for the maintenance and for the fuel to keep the generator in operation. While the gift was large it none the less carried a cost with it. Much the same argument was made for the provision of water pumps in Bangladesh. The pump was provided by the government but the farmer(s) provided the fuel and the maintenance. Again, a large gift with a real upkeep cost. Photovoltaics represents a greater gift because there is no or little maintenance and no fuel cost. As a result the technology represents, within the rural power system a means of influencing even more than before the social structure of the area and of benefitting the larger farmer to the detriment of the smaller, or of rewarding the loyal region to the detriment of that of the opposition. While it is not possible for a plan such as that under development to consider all problems such as these in the design of the plan, the nature of the technology requires that these considerations be recognized and that their potential social impacts be noted.

In summary, the workshop attempted to present a view from the developing nations on the likely acceptance of photovoltaics and the channels for introduction of the technology. It was not believed that the technology could be marketed directly as it was not a good bought and sold, but one component of a system to perform a specific function such as pumping water. With this caveat in mind, the workshop pointed to a number of alternative pathways for influencing aid giving agencies to include photovoltaic systems in their development projects.

Appendix One

MEETING ATTENDEES July 9, 1979 Photovoltaic International Plan

John Briscoe, Harvard University

Paul Carpenter, Jet Propulsion Laboratory

Dennis Costello, Solar Energy Research Institute

Russell deLucia, Meta Systems, Cambridge, MA

Thomas Klein, M.I.T.

Thomas Neff, M.I.T.

Lewis Perelman, Jet Propulsion Laboratory

Peter Rogers, Harvard University

Douglas V. Smith, Consultant

Alan Strout, Consultant (M.I.T.)

Richard Tabors, M.I.T.

Appendix Two

PHOTOVOLTAIC INTERNATIONAL PLAN

CAMBRIDGE REVIEW MEETING

July 9, 1979

10 AM to 3 PM

PURPOSE: Discuss preliminary structure of photovoltaic international plan, including justification for U.S.D.O.E. involvement and alternative strategies for plan implementation.

Review avenues for acceptance of U.S. manufactured/non U.S. manufactured photovoltaic power systems within developing nations with particular attention to the alternative financing, manufacturing, and marketing structures available and to alternative means of developing test and demonstration programs.

The following set of questions are presented to offer areas of consideration. They are not intended to be all inclusive but rather to offer points of departure for the discussion.

Role of Photovoltaics in development:

- o Is there a market for photovoltaics in the developing nations? If so, where, how large in what types of applications?
- o What are the economic market constraints?
- o What are the financial market constraints?
- o What are the physical/infrastructure constraints?
- o How do (do) photovoltaic power systems fit into the development requirements of the nations themselves?

U.S. Government involvement:

- o Should the U.S. Government be actively involved in the support of U.S. manufactured photovoltaic power systems in the developing nations?
 - direct support to manufactures
 - indirect support through licensing
 - indirect support through embassy assistance
 - indirect support through R&D efforts inside of the United States
 - no direct or indirect support

Agency/private sector involvement:

- o What agencies of the U.S. Government or other multilateral groups would lead or be involved in a photovoltaics development effort?
 - USDOE
 - USAID
 - IBRD
 - UNDP or UNIDO or UNEP
- o What are the options open for alternative forms of involvement by the private sector?
 - Sales only
 - Joint Venture activities ranging from marketing through full manufacture
 - In country licensing agreements

- o What are the constraints to private sector involvement and their means of reducing/eliminating these constraints?

LDC Response:

- o What are the likely responses of developing nations to the introduction of a high technology energy source such as photovoltaics?
- o Does the type of response vary by level of development, by level of industrialization, by agricultural structure, etc?

If there is to be a federal DOE program:

- o What are the planning options, i.e., should the effort be sectorally specific -- agriculture or rural electrification -- or should the program be region specific -- Asia or Africa.
- o What levels of funding would be required and how much is too much?
- o What type of cooperative, interagency relationships are both necessary and possible?

Testing and demonstration activities:

- o Should tests and demonstrations be related to efforts to promote U.S. industries in the developing nations?
- o What is a "good" demonstration project in a developing nation context?
- o Where are the pitfalls and how (if) can they be avoided or minimized?
- o What is the correct level of monitoring and evaluation and in what areas --
 - social
 - technical
 - economic